

GEL BAIT AVERSION RESISTANCE IN THE GERMAN COCKROACH: TOXICOLOGICAL AND EVOLUTIONARY CONSIDERATIONS

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Abstract Insecticide resistance in insects is a well-documented phenomenon that is equally related to toxicology and evolutionary biology. Insecticide resistance in the German cockroach has a long history dating back over 60 years. Thus, the recent evolution of gel bait aversion resistance is but one example from a long history of remarkable adaptation by this pest. Recent examples from the refereed literature support a “tradeoff” hypothesis with respect to the evolution of gel bait resistance. Specifically, resistance to gel baits apparently is the result of a complex evolutionary scenario in which there is a tradeoff between physiological and behavioral resistance. This evolutionary tradeoff is as follows: (i) in cockroach strains where physiological resistance predominates, it appears that behavioral avoidance of gel baits is minimal or absent; and conversely (ii) in strains where clear behavioral avoidance exists, it appears that physiological resistance is minimal or absent. Based on what is known from decades of research on insects, physiologically based insecticide resistance can be the result of either enhanced metabolism of the bait active ingredient (AI), target site insensitivity to the AI, or an interaction of both factors. Based on what is known regarding behavioral resistance in insects, behavioral resistance to gel baits is likely to be the result of either avoidance of the AI, inert ingredients contained in the bait matrix, or an interaction of both factors.

To better understand gel bait resistance, and to identify potential strategies for its management and prevention, it will be necessary to understand the full complement of potential mechanistic interactions (i.e., physiological vs. behavioral) from an evolutionary perspective. At this point in time, an understanding of the complex relationship between the toxicology of insecticide AIs and specific adaptations involved with enhanced detection/avoidance of insecticide baits seem most prudent for characterization. Developing this understanding will allow for long-term resistance management through manipulation of formulation chemistry and bait composition, as well as bait application programs that minimize the potential for resistance evolution.

Key Words *Blattella germanica*, insecticide resistance, genetics, physiology